THE IMMUNE SYSTEM--PART 2

Home
Breeder's Directory
Article Index
Journey Into Learning
News and Views
Important Info about NR News
Ordering Info
How to contact us
Search
Read Me
Catalogue

Journey Into Learning

Introduction
Nutrition And Supplements
Diet
Vaccinations
Homeopathy Basics
Homotoxicology - Some Basics
Fundamentals of Homotoxicology
Redefining The Modern Dog
Steroids: The Great Pretender
The Rise (and Fall) Of Antibiotics
Can Antibiotics Cause Infections
BioSET New Millenium Medicine
Bioset - Page 2
Bioset - Page 3

The immune system has many weapons to use in its war against invaders. The two main lines of cellular defense are the T Lymphocytes and the B lymphocytes (small white blood cells). Both T cells and B cells originate in the bone marrow. B cells remain in the bone marrow until they are mature, whereas the T cells are so named because they mature and/or are instructed in their duties in the thymus gland (a small organ located under the upper breastbone).

Lymphocytes can travel throughout the body, using either the blood vessels or their own system of lymphatic vessels. Like small creeks that empty into larger and larger rivers, the lymphatic vessels feed into larger and larger channels. At the base of the neck they merge into a large duct, which discharges its contents into the blood stream. The lymphatic vessels carry LYMPH, a clear fluid that bathes the body's tissues.

They can also be found in secondary lymphoid organs such as the spleen, lymph nodes, and other lymph tissues, including tonsils, the Peyer patches of the gut, and the respiratory and urinary tracts. Lymphocytes can also accumulate in the connective and epithelial tissues throughout the body.

In the last part we provided some basic information on the B cells and their primary function (and limits). In this issue we would like to give you some basics regarding the T cells and the "Cell Mediated" immune system.

T cells contribute to the immune defenses in two major ways. Some direct and regulate the immune responses. Others are killer cells that attack cells that are infected or cancerous.

Helper-Inducer T Cells, also called helper T cells are the commanders of the immune army, and serve as the central hub of immune operations. The chief responsibility of the helper T cells is to rouse the other defender cells into motion. They interpret intelligence information and communicate with all other lymphocytes through numerous specific chemical messengers.

It is important to understand that one line of communication is directed to the B cells. As mentioned previously, the B cells do the "dirty work" of the immune system by producing antibodies. But, unlike the T cells, which are always on active duty, moving throughout the entire blood and lymphatic routes on surveillance missions, B cells do much less traveling and rest inactive in the lymph system until the T cell calls them to the site of attack. When the helper T cells recognize a virus, bacteria, etc. they stimulate B cells to make antibodies specific for that particular foreign agent. Antibodies then help to destroy the invader.

Thus much of the activity of the B cells is directly attributable to the health and activity of the T cells!

Helper T cells are long-lived and many become memory cells. Whenever they spot a future exposure to the same agent, they'll initiate an even faster and more vigorous immune response. Only a few of the B cells will become memory cells.

Suppressor T Cells keep B cells in check by inhibiting their antibody production in order to prevent over- production. Suppressor T cells also accomplish this goal by direct suppression of helper T cells.

Cytotoxic T Cells are instructed/activated by helper T cells to kill invading cells that are, for example, infected with viruses.

NK (Natural Killer) Cells are also created by helper T cells to kill tumor cells and probably microbial organisms. They perform their work by drilling holes in the membranes of enemy cells. Unlike B cells, natural killer cells do not need to be stimulated into action. They can recognize foreign agents and act independently; and thus, they are born or "natural" killers. Their activity is enormously augmented, however, by communication from a helper T cell that has been sensitized by previously recognizing the same specific foreign invader.

K Cells, like natural killer cells, kill foreign invaders. However, unlike NK cells they require the help of an antibody made by B cells specific for the enemy cell.

Both kinds of killer cells can slay on contact by means of a lethal burst of chemicals.

Although lymphocytes are the main line of defense utilized by the immune system, they are by no means the only types of white blood cells that make up the total picture.

Most of you will be familiar with the term "macrophage". I have referred to these before as the "garbage collectors" of the immune system. But let me get a little more technical and bring in a couple of other terms that you may run across that can cause confusion.

Phagocytes (or "cell eaters") are large white cells that can swallow and digest microbes and other foreign particles. Monocytes are phagocytes that circulate in the blood. When monocytes migrate into tissues, they develop into Macrophages, or "big eaters". Kuppfer cells in the liver are an example of a macrophage.

Activated by sensitized helper T cells, circulating monocytes are converted to macrophages, which are central in triggering the immune response. The macrophages engulf the foreign agent and highlight their antibodies so the helper T cell can quickly identify the invaders. Once the antibodies are marked by the macrophages as foreign invaders, helper T cells determine the immune response needed to neutralize or destroy the body's invader. Thus, the macrophage serves as a scout, providing the intelligence information with which the helper T cell determines subsequent immune response.

So our old friend the macrophage plays many roles. As scavengers, they rid the body of worn out cells and other debris. They display bits of foreign antigen in a way that draws attention of matching lymphocytes. And they churn out an amazing variety of powerful cytokines, known as monokines, which are vital to the immune response.

The battle then goes into full gear. Macrophages secrete more chemicals, or lymphokines with names like gamma-interferon, interleukin-3, Alpha-interferon, etc. and a stimulating factor for granulocytes in order to eliminate the invading threat. These substances in turn alter and strengthen the surrounding macrophages, enhancing their ability to unleash a biochemical attack to kill the microorganism.

Granulocytes are white blood cells that contain granules filled with potent chemicals that allow them to destroy the enemy.

Some of these chemicals such as histamine also contribute to inflammation and allergy. One type of granulocyte, the neutrophil, is also a phagocyte; it uses its prepackaged chemicals to degrade the microbes it ingests. Neutrophiles are summoned to sites of inflammation and infection. Eosinophils and Basophils are granulocytes that "degranulate", spraying their chemicals into harmful cells or microbes nearby. Eosinophils congregate particularly at sites of allergic and parasitic reactions. They release enzymes to relieve the biochemical cause of allergy attacks. Basophils are found throughout the blood stream and at sites of inflammation.

Mast Cells are a twin of the basophil, except they are not a blood circulating cell. They are found in the lungs, skin, tongue, and linings of the nose and intestinal tract. They play an important role in the symptoms of allergy.

By now you are able to truly appreciate the complexity and intelligence of the immune system. It's not important to remember all the names you have just read, but it is important (for those that choose to think for themselves) to realize that the concept of a "strong" or "weak" immune system involves a great deal more than simply vaccinating.

Let me summarize what we have covered so far.

- The bone marrow and thymus are the main organs of the immune system.
- Helper T lymphocytes are the hub of operations, serving as both intelligence officers and battle commanders, communicating to and enabling other white cells of the immune system to perform their various combat tasks. Such communications are delivered in the form of the various chemical messengers--lymphokines--interleukin-2, gamma-interferon, colony stimulating factors, and others.
- Macrophages primarily issue the call to battle in their role as scouts; then they are promoted to elite battalions. The helper T cell commanders, armed with the intelligence information gathered by the scouts, can now recognize these foreign antigens and decide what lymphokines to secrete. This determines which branch of the immune system will be engaged and/or enhanced.
- Under helper T cell direction, cytotoxic T cells, NK cells, macrophages, and B cells all perform their various combat tasks.
-

Humoral (antibody B cell mediated) immunity is generally considered a separate arm of the immune system and viewed as separate from cellular/T cell immunity. Technically, however, antibodies are not separate since B cells also depend upon communications from helper T cells to perform their task of producing antigen-specific antibodies. Another factor that diminishes their separateness is the fact that when these antibodies bind to or coat foreign agents they make it possible for some components of the cellular immunity system to function effectively.

Nothing serves as diligently in the war against disease as the skin that covers our bodies. Although our skin is not inherently part of what we consider to be the immune system organs, our outer covering plus--the epithelial linings of the mouth and gastrointestinal tract; the nostrils, sinuses, bronchials, and lungs, the respiratory tract; the genitourinary tract, and the conjunctiva of the eyes--all serve as primary barriers to infection.

In a state of health, these rapidly replicating cells of our skin and the linings of our various tracts prevent attachment and penetration by infectious agents, primarily by secreting mucus (a protective agent that lines cells), secretory IgA (which helps sequester foreign agents), and lysozymes (enzymes that actually digest foreign organisms).

As always, the "moral" of the troops can play an important role in this mans army. Keep in mind that our thoughts and emotional reactions exert an enormous influence over our immune system through the network of nerve fibers from the brain and spinal cord as well as the "neuropeptides" secreted into the bloodstream. The central and autonomic nervous systems communicate directly with the organs of the immune system. Therefore, what we think and feel and believe has a powerful ability to affect the function and size of the thymus gland, lymphocyte counts and ratios, lymphocyte function, and lymphokines and antibody secretions.

There are a multitude of studies that have clearly demonstrated that stress, personality, attitude and emotion are causative factors in many disease. Reaction to stress is entirely individual, reinforcing the fact that people and animals differ significantly in their perception and response to various

events. The variations in response help account for the wide diversity of stress-induced illnesses.

Stress causes increases in the adrenal gland hormones including corticosteroids and catecholamines. Among other things, these hormones inhibit white blood cells and cause the thymus to shrink! This leads to significant suppression of the immune function, leaving the host susceptible to infections, cancer and other illnesses. The level of immune suppression is usually proportional to the level of stress.

For those of us that breed and show our animals, we must realize that we place a higher level of stress on them than the majority of pet owners. Thus we have the responsibility of ensuring that we also provide them with the means and ability to optimize their immune system.

If we are to strengthen the immune system we must consider what will bolster lymphocyte and other white cell counts, and their critical secretions, such as interferon and interleukins, and antibody levels. We must consider what will repair and maintain the integrity of the skin and mucosal epithelial linings.

Obviously we must address the nutritional foundations for maintenance, balance, and enhancement of the immune functions. We will get into this in our next issue. (Part 3)

Feel free to contact us if you have questions or concerns.

Send mail to **Webmaster** with questions or comments about this web site.

Last modified: June 07, 2006